Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY14

Project ID: FNAL-LDRD-2014-028
Project title: Deployment and operation of prototype CCD array at Reactor Site for detection of Coherent Neutrino-Nucleus Interactions
Principal investigator: Juan Estrada

Project description: (short description and explanation of cutting edge, high-risk, high-potential science or engineering)

The project is to measure detector performance and background rates with an eye towards conducting an experiment to detect, for the first time, direct evidence of coherent neutrino scattering with nuclei. The project will first deploy an existing 10g CCD array, composed of 250μm thick sensors and operated with low noise and hence very low threshold energy, next to the existing Angra nuclear reactor in Brazil from which low energy neutrinos are emitted. The novel nature of the CCD and its readout scheme is to have a low energy threshold by about a factor of 100 smaller compared with typical particle detectors. If successful, a second array composed of more novel 650μm thick detectors would be similarly deployed as these thicker devices would be required for a full experiment.

Tie to Mission: (explain the project's relevance or anticipated benefits to Fermilab's and DOE's missions)

Coherent neutrino scattering with nuclei is an expected phenomenon within the Standard Model and quantum mechanics but has been experimentally elusive. A number of initiatives world-wide have sought to observe the effect but success has been limited due to experimental considerations such as a high energy threshold for detection. If successful, a new window into studying low energy neutrino effects will be opened. The project will also demonstrate the ability to detect the presence of low energy neutrinos.

Previous year's accomplishments: (as applicable) FY14, not applicable

Work proposed for current fiscal year and anticipated / desired results:

The project proposes to install an existing prototype detector in a potentially suitable environment to measure background rates and energy threshold. If these measurements are encouraging, the next steps in FY15 would be to demonstrate stable and reliable operation of the detector prior to committing to deployment of an array composed of prototype thicker sensors.

Project funding profile: (costs, budgets, projected budgets, and total)

Prior year(s) costs	FY14	FY15	FY16	Total
N/A	70900	110100	-	181000